

EXPLOITATION OF BIO-BASED AND MICROBIAL PRODUCTS IN INDIAN CLEANING SCIENCE

Vasudeo Zambare*

Aesthetika Eco Research Pvt Ltd, Ambad MIDC, Nashik 422010, INDIA

*Corresponding author; E-mail: aesthetikaer@gmail.com

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Corresponding Author:

E-Mail:

aesthetikaer@gmail.com

ABSTRACT

The cleaning awareness is growing in the wake of the COVID-19 pandemic, and the demand for personal hygiene and homecare products is rising and expected to rise the global compound annual growth rate (CAGR) of 4.5% during 2021-26. Nearly, 84% of the users changed and adapted the new cleaning practices in the ways they clean their homes. Hence, the behavioural changes during pandemic has made users more aware about their hygiene at personal as well as home for reduction of chances of infections. Thus, the demand for household cleaning products is increasing exponentially. The most commonly and dominated household products are supplied by chemical industries which are experiencing ups and down in recent years but during the global COVID-19 crisis, the chemical sector is going to be benefited. Among these homecare products, 90-95% contains hazardous chemicals and hence the health and hygiene have become priority issues for government at the national level as well as for users at the individual level. As with the medical industry, the chemical cleaning product sector has seen an increase in demand during the current health emergency but its has some direct and indirect issues related to health and environmental pollution. This paper mainly focussing on the health and environmental issues of chemical based cleaning products, its challenges and opportunities for health and environment friendly safe alternatives. Considering the global need and user safety, Indian startup launched bio-based and natural homecare cleaning products which are made from microbial fermentation, plant extracts and its essential oil based components. The surge in innovation and novel cleaning technology has led to the development of homecare brands excellent in: germ fighting property, dirt or stain removal efficiency, shining and naturally feeling pleasant aromas with

added health and environment friendly concerns of biodegradability, cost effectiveness, risk-free handling and completely safe to all forms of life. Innovative and modernised cleaning technology with unique selling propositions (USPs) shifted a paradigm from chemical to biological cleaning science and practices making India as Aatmanirbhar Bharat, Swachh Bharat and Swastha Bharat.

Keywords: cleaning science, cleaning products, hazardous chemical, health, environment; bio-based, natural

INTRODUCTION

Covid-19 crisis and pandemic situation was worst from 2020 to till date and globally, it has a big set back on day to day activities, businesses and overall global growth. Peoples are now a days aware about the cleaning and hygiene practices. In this context of COVID-19, the World Health Organization (WHO) has released an interim guidelines on cleaning and disinfection of environmental surfaces¹. Environmental surfaces include furniture, electronic equipments, bathrooms, sinks, toilets, kitchen, staircases, lift rooms, floors and walls and are more likely to be contaminated with COVID-19 virus. Therefore, these surfaces, especially where patients with COVID-19 are being cared for, must be properly cleaned and disinfected to prevent further transmission.

WHO recommended chlorine based disinfectant for surface cleaning containing hypochlorite-based products include liquid (sodium hypochlorite), solid or powdered (calcium hypochlorite) formulations. Hypochlorite displays a broad spectrum of antimicrobial activity and is effective against several common pathogens at various concentrations^{2,3}.

Though it has cleaning performance but the cleaners must need to wear the adequate personal protective equipment (PPE) and be trained to use it safely. These disinfectant linked with eye, skin, respiratory irritations, noxious gases and burning sensations⁴. Dominantly, cleaning products are chemical based and has adverse effect on human health and environment. Thus, The present paper herewith explaining the impact of all chemical based cleaning products not only for its cleaning effectiveness but also a bad impact on health and environment. Being a entrepreneur and startup innovation of Aesthetika brands, our main focus is to aware the every person body about the merging and growing field of cleaning science specially with a organic, natural and bio-based technology based innovative products for better health and environment.

Cleaning science

Cleaning science is a branch of surface science aiming to use cleaners, disinfectant and protectants for removal of unwanted substances from the environment including contaminant, pathogen, chemical residues, or pollutants⁵. Homecare is the biggest segment where the cleaning products are the

essentials requirement for daily care and cleaning purpose in households. The homecare products generally include surface and air treatment products, including floor cleaners, glass cleaners, surface cleaners, toilet cleaners, disinfectants, laundry detergents, dishwashing products, stain removers, air fresheners, and others.

Cleaning market⁶⁻⁸

The global household cleaning product market in 2021 about US billion 235.76 is likely to grow upto US billion 320.82 by 2028 with a CAGR of 4.5%. Asia Pacific region showed US 76.80 household cleaning product market, however, the 18% of Asian market is covered by India (US billion 13.9). The major household items are categorising into laundry detergent (54%), surface cleaner (21%), dish cleaners (15%), toilet cleaners (4%) and other (6%). The household items are used for maintaining hygiene and a good aura of the homes. And the global homecare products market is increasing day by day with an incremental growth of US billion 14.26 in 2022 and likely to be raised upto US billion 20.13 by 2024 with a CAGR of 5% and 6%, respectively. Due to the highly populated region, the Asia Pacific showed maximum 39% growth followed by 38% in Americas.

Man made chemical intervention and microbial dynamics

Cleaning is important for good health and hygiene and good cleaning practices are normally followed by individuals, industries, institutions, and corporates. Many new molecules have been introduced by many manufacturer for cleaning surfaces and utensils. However, the chemical used in

our day to day life are not as safe as we are considering. One of the study showed that we are exposed daily to total 85,000 of industrial chemicals which are present in our household items. Some of them are perchloroethylene (a common solvent in dye cleaning gets trapped in clothing), per-fluorinated compounds (in non-sticky cookware), flame retardants (in furnitures, needing mattresses, rug pads), pesticides (in pest control), fragrances and paragon based preservatives. Considering the homecare sector, there are monoethanolamine, ammonium quaternary compounds, acids, allergens, 1,4, dioxane, galaxolite, preservatives which leads to formation of toxic fumes, gasses, volatile matters, toxins and damage the three level's (soil, water and air) life and climate too. The chemical based cleaning products has lot of limitations of mixing with other chemicals and ultimate results of dangerous accidents⁹.

Such chemical interventions impacted on microbial communities which are responsible for our good health and hygiene. A huge microbial dynamics has been observed due to the strong doses and actions of chemical based cleaning products. The toilet and faecal matter conversion rates are changed due to excess use of highly hazardous and dangerous acids. The chemical based air fresheners decreases the beneficial microbial load in air, floor cleaners damages the surfaces as well as native beneficial microbial population and left us the residual of toxins on the surfaces. Pathogenic microbes are very prone to develop a resistance against any chemical and hence drug resistance pattern is also increasing. Resultant into damage of beneficial microbes and leave bind the

resistant pathogens¹⁰. Thus, chemical based homecare products are not good for our health and the society and need to find something bio-based and natural originated products.

Health and environmental impact

Globally, health and the environment are very important sectors and chemical based cleaning solution showed adverse effect in both¹¹⁻¹². Human, plant, animal and aquatic life has very adverse and impactful effect of chemical based cleaning products and that categorised various hazards such as carcinogens, endocrine disruptors, fire retardants, high risk pesticide, heavy metals, behavioural toxin, developmental toxin, neurotoxin, reproductive toxin, toxic solvents and harmful volatile organic compounds (VOCs)¹³. Household chemicals such as perchloroethylene, galaxolide and preservatives causes hormonal and endocrine disruptions, monoethanolamine and allergens are linked with asthma¹⁴⁻¹⁵, ammonium quaternary compounds linked to reproductive toxicity, skin, eye and respiratory irritations, harmful acids, 1,4 dioxane, phthalates, sodium lauryl ether sulphates linked for skin diseases and cancers¹³. Apart from this, many more cleaning chemical are involved in thyroid disorder, breast cancers, mental stress, miscarriages as well as kids and pets accidents.

Active chemical and its derivatives deeply and vertically affecting the environment in terms of air, soil and water. Aerial contamination was due to the cleaning chemical which generate fumes and VOC's that damage the beneficial microbial communities, increasing resistance pattern

in microbes and mainly involved in the global warming¹⁶. Soil pollution is due to the utilization of sewage based water contaminated with cleaning chemicals and their derivatives kills the agriculturally beneficial nitrogen fixing, metabolite solubilising, mineralising microbes. Also entering into the food chain and disturb the natural balance. Water pollution is the next step of Extension of sewage and untreated waste water and its percolation in underground water stream, river irrigation water stream. It affect the aquatic life from small canal to huge oceans. Due to this, our life is becoming more challenging day by day. Chemical based chemicals affect the sewage tanks, it gets chock up, due to highly acidic natures the 2929 matter degrading microbes are getting lysed and which results into the sticky smell from septic tanks, and its related pollutions.

Role of microbes and microbial products in cleaning and hygiene

Microorganism play a great role in cleaning the environment by its decomposition property on nature that it degrades the organic components of the waste material in sewage as well as environment into its constituents which can be reused by plants to make their food and hence it plays a great role by its action. In sewage treatment aerobic bacteria destroys the organic waste and mixes it with the ground below the water as a layer which is utilised as manure too¹⁷. Microorganisms are being used for a multitude of purposes. Some probiotic produced bacteriocin and antibiotic substances which kills the pathogen¹⁸. Microbes secretes hydrolytic enzymes which clean up the dirt, fat, protein, soil, oil, stains by enzymatic action of enzyme cocktails

containing protease, lipase, amylase, esterase, cellulase, pectinate, laccase, lactase, xylanase, etc¹⁹. Microbial fermentation product produced secondary metabolites or a metabolic end products of organic acids and biomolecules which showed sanitary effect of germ and dirt stain removal. Thus, the microbial cleaning technology would be

- 100% Natural/ organic originated
- 100% safe and hygienic
- Biodegradable
- Sulphate and paraben free
- Accident free handling
- Non-irritating
- Non-allergic
- Non-toxic

Globally, Asia Pacific region is expecting a largest 39% market growth with an Indian market of USD 13.9 billion, where 80% market shares belongs to foreign companies. To make India as self sustainable, Indian start ups utilising the rich tradition of biodiversity, ancient medicinal and scientific knowledge for the innovative development of indigenous bio-based technologies for betterment of health environment and a social and economic contribution for Indian Government's national missions of Aatmanirbhar Bharat, Make in India, Swachh Bharat and Swastha Bharat.

CONCLUSION

Chemical based cleaning products showed adverse effect on health and environment due to its harmful chemical profile. It linked with soil, air and water pollution. Each

a very natural and effective way of cleaning the surfaces in the cleaning science.

Advantages of bio-based cleaning products

Due to the safe and natural alternatives, microbial or bio-based cleaning products would be the best suited products in terms of health and environmental protection. The USPs of such products includes:

- Non-polluting
- Non-flammable
- Non-pathogenic
- Eco and environment friendly
- Spread pleasant natural fragrance
- Effective cleaning performance
- Residue free
- Safe for kids and pets

individual must aware about the bad impact of chemical based cleaning solutions and use organic, natural and bio-based greener cleaning products for healthier and cleaner environment.

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